(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 201 367 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.05.2002 Bulletin 2002/18

(51) Int Cl.7: **B24D 3/14**, B24B 53/12

(21) Application number: 01305243.6

(22) Date of filing: 15.06.2001

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 26.10.2000 JP 2000327146

(71) Applicant: Read Co., Ltd.
Yokohama-shi, Kanagawa (JP)

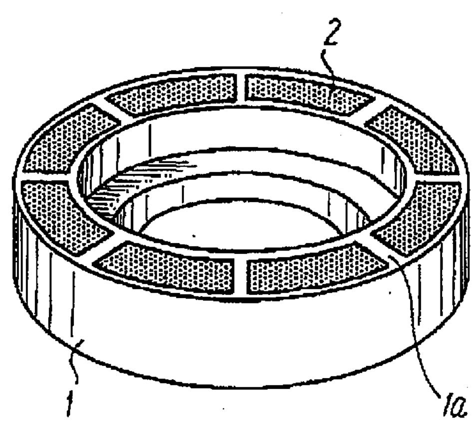
(72) Inventors:
- Kimura, Kenichii
Watari-cho, Watari-gun, Miyagi (JP)
- Kaenanri, Moriyasu, c/o Read Co., Ltd.
Watari-cho, Watari-gun, Miyagi (JP)
- Sato, Hidemi
Iwanuma-shi, Mayagi (JP)

(74) Representative: Findlay, Alice Rosemary
Lloyd Wise, Tregear & Co.,
Commonwealth House,
1-19 New Oxford Street
London WC1A 1LW (GB)

(54) **Dresser for polishing cloth and manufacturing method therefor**

(57) A dresser for a chemical and mechanical polishing cloth is provided in which a sintered product constituting the dressing face 2a is obtained by mixing a bonding material 4 consisting of silicon and/or silicon alloy with diamond grit 3, and forming and sintering the mixture. A carbide film 5 generated by sintering silicon in the bonding material into diamond is formed on the surface of the diamond grit 3. Thereby, the diamond grit is firmly bonded with the bonding material, and the bonding material is not dissolved. Preferably, the particles of the diamond grit are arranged on the surface of the bonding member with two-dimensional regularity, the distance between adjacent grits on the smallest lattice formed by the arrangement is within a range between 10 µm to 3,000 µm. Thus a uniform dressing surface can be created.

FIG. 1



Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a dresser for a polishing cloth used for removing clogging or foreign material in a step of Chemical and Mechanical Polishing (hereinafter referred to as CMP) and to a manufacturing method therefor.

[0002] In manufacturing highly integrated electronic circuits such as integrated circuits, CMP processing is generally used to remove surface defects such as protrusions, crystal lattice defects, scoring, or roughness on a conductive layer, a dielectric layer or an insulation layer formed on a substrate or wafer. In CMP processing, a wafer is pressed on an abrasive cloth made of polyurethane foam or the like by a predetermined load, adhered to a disk surface plate, and the wafer is polished by rotating both the wafer and the cloth with an abrasive fluid called a chemical slurry. A preparation in which abrasive particles such as iron oxide, barium carbonate, cerium oxide, or colloidal silica are suspended in an abrasive fluid such as potassium hydroxide, dilute hydrochloric acid, aqueous hydrogen peroxide, or iron nitrate, is used as the chemical slurry, and those are selected as required according to the polishing speed, the kind of object to be polished, etc.

[0003] CMP is performed many times in steps for stacking various kinds of electronic circuits on a substrate or a wafer. When the number of CMPs is increased, particles of polishing dust burrows into minute cracks, causing clogging, and this reduces the polishing rate. Accordingly, an operation by which the surface of the polishing cloth is replaced to restore the polishing speed, called dressing, is required to be executed often or regularly. For this operation, an instrument called a dresser for a CMP polishing cloth is used.

[0004] Since diamond grit is an excellent dressing material, a known dresser for a CMP polishing cloth employs diamond grit. To make the dresser, a method of electrode depositing the diamond grit on stainless steel by nickel plating has been proposed. Also, in Japanese Unexamined Patent Application No. 10-12579, a method of brazing the diamond grit on the stainless steel by a metallic-brazing material has been proposed.

[0005] However, the nickel plating material or the metallic-brazing material is dissolved by strongly acidic chemical slurry, and the slurry is contaminated and the diamond grit is peeled, potentially causing scoring on the surface of the wafer. Therefore, a dresser for CMP abrasive cloth in which dissolution of metal or peeling-off of diamond grit will not occur in CMP is desired.

[0006] In a conventional dresser for polishing cloth, grit such as diamond grit is usually randomly arranged. Japanese Unexamined Patent Application Publication No. 2000-141204 shows an example in which diamond grit is arranged substantially uniformly, approximate in concentric circles. In this case, the distance between the pieces of grit is not equal and the grit is arranged irregularly. Therefore, stable polishing performance cannot be exhibited and a uniform surface of the polishing cloth cannot be obtained, and furthermore, the polishing speed cannot be adjusted arbitrarily. For example, if the distance between the pieces grit is small, swarf or polished particles generated by grinding adhere among the grit and are not discharged, or a part of the polishing cloth is melted due to frictional heat on grinding, thus causing clogging, and this causes a decrease in performance of the dresser and the surface of the polishing cloth becomes a mirror surface resulting in a decrease in the polishing speed.

[0007] Furthermore, with a conventional dresser for a polishing cloth, as dressing of a polishing cloth and polishing a wafer are always carried out on the same polishing plate, scraps of the polishing cloth or polished dust are not sufficiently discharged and so damage is caused on the surface of the wafer and this causes a decrease in yield.

[0008] Furthermore, clogging of the dresser for a polishing cloth causes application of concentrated stress at the clogged parts, the grit is removed from a holding part, and scratches are caused on the surface of the wafer resulting in fatal damage.

[0009] It is an object of the invention to provide a dresser for CMP polishing cloth and a manufacturing method therefor in which bonding material for holding the diamond grit will not be attacked by the strongly acid chemical slurry, causing contamination of the slurry by metallic dissolution or peeling off of the diamond grit CMP.

[0010] It is another object of the present invention to provide a dresser for a polishing cloth and a manufacturing method therefor in which stable grinding characteristics are maintained, a uniform dressing surface of the polishing cloth is created, and the polishing speed is always constant.

[0011] It is another object of the present invention to provide a dresser for a polishing cloth and a simple manufacturing method therefor in which, by correctly adjusting the distance between the pieces of grit, the dresser is suited to the workpiece and polishing efficiency can be adjusted at will.

[0012] A dresser for a polishing cloth according to a first aspect of the present invention has a dressing face comprising a sintered product obtained by mixing a bonding material comprising silicon and/or silicon alloy with diamond grit, and forming and sintering the mixture such that a carbide film generated by sintering the silicon in the bonding material into the diamond is provided on the surface of said diamond grit, whereby the diamond grit is firmly bonded with the bonding material.

[0013] A dresser for a polishing cloth according to a second aspect of the present invention has a dressing face comprising a sintered product obtained by mixing a bonding material comprising silicon and/or silicon alloy with diamond

grit coated with a film of a carbide of a metal in the group IV, V or VI of the periodic table, and forming and sintering the mixture, such that the diamond grit is firmly bonded with the bonding material with said carbide film.

[0014] Preferably the sintered product is formed by arranging each particle on the surface of the bonding member so as to have two-dimensional regularity, the distance between adjacent pieces of grit on the smallest lattice constructed by the arrangement is within a range between 10 μm and 3,000 μm and each piece of grit is arranged in a substantially uniform distribution. These features help produce a uniform dressing surface.

[0015] The sintered product may be adhered on the surface of a pedestal and finished into specified size, and the diamond grit may be exposed by planarizing and dressing the dressing surface.

[0016] A first method of making a dresser for a polishing cloth according to the present invention comprises mixing bonding material comprising silicon and/or silicon alloy with diamond grit, sintering the mixture such that a carbide film is generated by sintering the silicon in the bonding material on the surface of the diamond grit, and the diamond is firmly bonded with the bonding material by the carbide film.

[0017] In a further manufacturing method according to the present invention a bonding material comprising silicon and/or silicon alloy is mixed with diamond grit coated with carbide film of metal in group IV, V or VI of the periodic table, and the mixture is formed and sintered whereby the diamond grit is firmly bonded with the bonding material by the carbide film.

[0018] In a still further manufacturing method, adhesive regions whose size is almost the same as that of the grit are provided on the surface of the planar bonding material comprising silicon or a silicon alloy or a sheet placed thereon in positions which are uniformly distributed with two-dimensional regularity, and after each grit particle is adhered on the adhesive regions, they are pressed down and sintered. Also in this case, a carbide film is generated on the surface of the diamond grit by reactive sintering of the diamond and the silicon in the bonding material, and thus, the diamond grit is firmly bonded to the bonding material with the carbide film.

[0019] When adhering the diamond grit on the adhesive regions, the diamond grit may be coated with carbide film of a metal in group IV, V, or VI in the periodic table in advance, and the diamond grit may be firmly bonded to the bonding material with the carbide film.

[0020] Furthermore, the adhesive regions may be formed by non-masked parts of an adhesive sheet masked with a non-adhesive material.

[0021] The bonding material comprising silicon and/or silicon alloy has excellent acid-resistance in acidic solutions such as nitric acid. As a result, polishing fluid is not contaminated, and this simplifies the wafer cleaning step after CMP.

[0022] Furthermore, in addition to the above, by arranging the diamond grit regularly with the appropriate grit distance, stable grinding characteristics can be maintained, surface roughness on the surface of the polishing cloth creates a uniform dresser surface, stable polishing can be always carried out with a constant polishing speed, and the grit distance of the diamond grit or the like which is arranged with regularity can be appropriately adjusted. Thus, the surface state of the dresser for the polishing cloth can be created according to a workpiece, and the polishing efficiency can be adjusted at will.

[0023] The invention will now be described by way of example with reference to the accompanying drawings in which:

FIG. 1 is a perspective view showing an example of a dresser for a polishing cloth according to the present invention,
FIG. 2 is a cross-sectional view showing the main part of the dresser that is cut at the flat face in parallel to the rotating center of the dresser,
FIG. 3 is a graph showing the results of an acid resistance test on the dresser and a comparative example.
FIG. 4 is an optical microscope photograph of the front surface of the dresser of Example 1,
FIG. 5 is an optical microscope photograph of the rear side of the dresser of Example 1 at the same position as in FIG. 4,
FIG. 6 is a graph showing the results of an acid resistance test of the dresser of Example 2,
FIG. 7 is a detailed cross-sectional view through a flat surface parallel to the center of rotation of an embodiment of a dresser in which the grit arrangement is regular showing the main part of the dresser.
FIG. 8 is an electron micrograph showing the arrangement of the diamond grit of the dresser of a first embodiment in which the diamond grit distance of the dresser is set to 0.8 mm.
FIG. 9 is an electron micrograph showing the arrangement of the diamond grit on the dresser of a second embodiment in which the diamond grit distance of the dresser is set to 1.5 mm.
FIG. 10 is an electron micrograph showing the arrangement of the diamond grit on the dresser of a comparative example.

[0024] In a dresser for a CMP polishing cloth according to the present invention, the dressing face thereof comprises a sintered product obtained by mixing a bonding member comprising silicon or silicon alloy with diamond grit coated with a carbide film generated by the diamond grit or the above-described metal from the periodic table, and by forming and sintering the mixture. In a preferred embodiment, the sintered product is adhered to the surface of a pedestal made

of ceramic, plastic or the like, then the dressing face is subjected to planarizing and dressing processing to finish it into specified size as well as exposing the diamond grit.

[0025] If the sintered product is obtained by mixing the bonding material comprising silicon or silicon alloy with the diamond grit and forming and sintering the mixture, a carbide film is formed on the surface of the diamond grit by sintering of the silicon in the bonding material into the diamond. Thereby, the diamond grit is bonded firmly with the bonding material.

[0026] Referring to the drawings, FIG. 1 and FIG. 2 show embodiments of a dresser for a CMP polishing cloth according to the present invention. FIG. 1 shows the overall constitution. FIG. 2 shows a cross-section of the dresser that is sectioned at the face through a central axis of rotation.

[0027] In the dresser for a CMP polishing cloth according to the example, a plurality of sintered products 2 are adhered to the working face 1a of the cup-shaped pedestal 1 made of metal, ceramic, or plastic. As shown in FIG. 2, the diamond grit 3 in the sintered product 2 has the carbide film 5 generated on the surface thereof. The diamond grit 3 is bounded firmly with the bonding material 4 by the carbide film 5.

[0028] If the bonding material 4 comprising silicon and/or silicon alloy is mixed with the diamond grit 3, the mixture is formed and sintered, the carbide film 5 is generated on the surface of the diamond grit by sintering the silicon in the bonding material 4 into the diamond grit 3. Also, the carbide film 5 can be formed by coating the surface of the diamond grit 3 with the carbide film 5 of a metal from group IV, V, or VI in the periodic table.

[0029] Grain size of the diamond grit 3 is not limited. Generally, it is preferable that the grit having a grain size of #325/#400 to #30/#40 according to JIS B4130 be used. If the grain size of the diamond grit is less than #325/400, exposure amount at the dressing face of the diamond grit is lower, and this cause imperfect dressing of a CMP polishing cloth or slower dressing speed. If the grain size of the diamond grit exceeds #30/#40, it might cause a rough face of the CMP polishing cloth when dressing or cause a lower rate of removal.

[0030] If silicon alloy is used as at least a part of the bonding member 4, preferably it has a silicon content of 15 percent by weight. Metals in groups IV, V, or VI of the periodic table may be used as alloy metal. In particular, titanium, chrome, tantalum, tungsten, or molybdenum is preferably used. If the silicon content is less than 15 percent by weight, the obtained sintered product 2 might have poor acid-resistance.

[0031] As a sintering method employable in the present invention, there are many methods including hot-pressing using graphite, pressure sintering with current, pressure sintering with discharge, hot isostatic pressing (HIP), or sintering with an ultrahigh pressure device. Sintering according to the present invention is not limited to certain sintering methods, but a preferable sintering method may be chosen and employed as required.

[0032] As a method of coating the carbide film 5 on the diamond grit 3, there is a PVD method, a CVD method, a plating method, or an immersion method using a melted salt bath. A preferable method may be chosen and employed as required.

[0033] If the sintered product 2 is used as a dresser, as shown in FIG. 1 and FIG. 2, the sintered product is fixed on the working face 1a around the pedestal 1 by an adhesive 6, then the dressing face 2a is planarized and is dressed. Thereby, the product is finished into a specified size and the diamond grit is exposed for dressing.

[0034] Since the dresser for a CMP polishing cloth constituted accordingly has a bonding material employing acid-resistant silicon or silicon alloy, metal never dissolves and the diamond grit is never peeled off by strongly acidic chemical slurry. Therefore, wafer-cleaning steps after CMP processing can be simplified and scratches on a work surface caused by peeling-off of the diamond grit from the dressing face 2a can be prevented.

[0035] In the above-mentioned dresser for the polishing cloth, as shown in Fig. 7 to Fig. 9, the sintered body 12 is constructed by arranging each particle of the diamond grit 13 on the surface of the bonding material 14 so as to have two-dimensional regularity, the distance between the adjacent pieces of grit on the smallest lattice constructed by the arrangement is within a range between 10 μm and 3,000 μm, and each piece of grit is arranged so as to form a substantially uniform distribution. These features are helpful to obtain a uniform dressing surface.

[0036] In this case, diamond separately classified in some range is used as the diamond grit 13, and the particle size thereof is not limited. However, generally speaking, it is preferable to select a grit included within the range mentioned-above. Also, silicon and/or a silicon alloy is used as the above-mentioned bonding material 14.

[0037] As shown in photographs of Fig. 8 or Fig. 9, each particle of the grit 13 is arranged to be fixed on the surface of the bonding material with two-dimensional regularity, the distance between the adjacent pieces of grit on the smallest lattice constructed by the arrangement is within a range between 10 μm and 3,000 μm, more preferably, the grit 13 has a grain size of #100 to #60 and a distance between the pieces of grit of 100 μm to 2,000 μm, and each piece of grit is arranged so as to form a substantially uniform distribution. In this case, the larger the distance of between the grit particles becomes, the more the polishing speed increases and the larger the roughness of the polishing cloth becomes. Also, the smaller the distance between the grit particles becomes, the more the polishing speed decreases, the smaller the roughness of the surface of the polishing cloth becomes and the more the polishing speed decreases.

[0038] When the distance between the pieces of grit 13 is 10 μm or less, since clogging occurs in the dresser due to a grinding layer of the polishing cloth or polishing particles, the polishing cloth cannot be uniformly ground. Also, the

distance between the pieces of grit 13 is 3,000 μm or more, a satisfactory grinding operation cannot be obtained. Therefore, it is preferable to select the distance between the pieces of grit according to the type of object to be ground or cost, as required, and the roughness of the polishing cloth or the polishing speed can be arbitrarily adjusted by adjusting the distance.

[0039] The arrangement of the grit 13 will be described more specifically. The smallest lattice produced by the particles of grit 13 which are adjacent in a circumferential and radial direction on a pedestal 1 (see Fig. 1 and Fig. 7) is, in general, a square or a parallelogram (this may be called a triangle formed by connecting opposing angles). In this case, it is enough for the distance to the closest adjacent particle of grit in this smallest lattice to be within the range from 10 μm to 3,000 μm. Meanwhile, although the shape of the lattice is not limited to the above-mentioned shape, each of the pieces of grit must be arranged with two-dimensional regularity.

[0040] The above-mentioned dresser for a polishing cloth will be easily manufactured by a method described below.

[0041] First, many particles of the grit 13 are held on the planar surface of the bonding material 14 to be mounted on the dresser for a polishing cloth with two-dimensional regularity. In this case, it is preferable that an adhesive part having almost the same size as that of the grit is provided directly on the surface of the bonding member 14 or via a sheet placed thereon according to the position of each piece of grit 13 arranged with regularity, and the grit 13 is adhered and fixed on the adhesive part.

[0042] The adhesive part may be formed by a non-masking part in the adhesive sheet which is masked. In this case, preferably, masking is performed by forming the non-masking part by making many holes having the same size as that of the particle size of the grit, and the adhesive part is formed by the non-masking part. However, the adhesive part may be formed by partial application of the adhesive using printing techniques. The size of the adhesive part must be almost the same as the that of the grit in order to adhere and fix each piece of grit 13, and they must be arranged at regular intervals two-dimensionally according to the holding position of each piece grit 13.

[0043] The grit 13 is sintered and fixed on the surface of the bonding material 14. In this case, as shown in Fig. 7, the diamond grit 13 is pressed into the bonding material 14 and sintered. At that time, a carbide film 15 is generated on the surface of the diamond grit 13 by reactive sintering of the diamond and the silicon in the bonding material, and thus, the diamond grit 13 is firmly bonded to the bonding material 14 by the carbide film 15.

[0044] Furthermore, grit coated in advance with a carbide film of a metal in group IV, V or VI in the periodic table is used as the above-mentioned diamond grit, and the grit is pressed into the bonding material and sintered. In this way, the diamond grit may be firmly bonded to the bonding material by the carbide film.

[0045] To form the regular two-dimensional arrangement in the grit 13 or the non-masking part, the following method may be used. Holes whose dimension is equal to the maximum dimension of the grit distribution are made on a metal plate with the required arrangement by etching, this metal plate is placed on the surface of a molded body or a sheet, the grit having a particle size distribution corresponding to the holes is fitted into the holes while being observed with an microscope, the grit is pushed into the molded body via a plate placed on the grit after the unnecessary grit is brushed off with a brush, and then, the metal plate is removed and the object is sintered under prescribed temperature, pressure, and time conditions.

[0046] As shown in Fig. 7, the bonding material 14 holding the grit 13 with a prescribed arrangement is bonded to a dresser pedestal 1 with an adhesive 6 such as epoxy resin, and then, the dresser surface is subjected to planarizing and dressing by shot blasting using unbound grit such as alumina, wrapping or etching to form a final prescribed dimension, and the grit 13 protrudes at a prescribe height. In this way, a dresser for a polishing cloth is manufactured.

EXAMPLES

[0047] Hereinafter, a further description will be given in detail, with reference to preferred examples. However, the present invention will not be limited by these examples.

[EXAMPLE 1]

[0048] Diamond grit having a grain size of #100/#200 is mixed with titanium-silicon alloy powder at 1:1 by weight so as to yield a mixture of volume ratio of 1:3. Then, an obtained mixed powder is filled in a graphite frame, and then it is sintered at a sintering temperature of 1,200 degrees Celsius and under a pressure of 50 Mpa for an hour by hot-pressing. After an obtained sintered product is adhered on a pedestal (refer to FIG. 1) made from a stainless steel (SUS 316) with an epoxy adhesive, the dressing face of the product is planarized and dressing-processed by using a GC grinding wheel having a grain size of #240 so that the thickness of the product and the height of protrusion of the diamond grit from the matrix may be 2 millimeters and 50 micrometers respectively. This forms a dresser.

[0049] The following acid-resistance test and durability test of grit-peeling-off were carried out on the dresser.

[0050] In the acid-resistant test, a sliced sintered product is dipped in 500 milliliters of ten weight percent of nitric acid water solution for 100 hours, then the rate of change in weight of the product is measured with an electrobalance

(measuring sensitivity 1 mg). FIG. 3 shows the rate of change in weight (vertical axis) to dipping hours (horizontal axis) . The figure shows that there was no weight decrease and that the product had superior acid-resistance.

[0051] For comparison, a sample in which diamond grit with a grain size of #100/#120 electroformed with Ni was subjected to the same acid-resistance test. The result shows that the rate of change in weight after 30 hours was 4 . 0 percent.

[0052] In the durability test of peeling-off, the dresser is pressed on the surface of a CMP polishing cloth made of urethane foam with a face pressure of 20 kPa, then the dresser was subjected to continuous dressing for 100 hours while slurry containing 2 weight percent of alumina abrasive grains having a grain size of #4000 is sprayed at 12 milliliters per minute. The surface of the dresser was observed with a optical microscope at four points to inspect peeling-off of the diamond grit and changes in height. FIGs.4 and 5 respectively show the results of the observation before and after dressing. According to these figures (photographs), no peeling-off of the diamond is observed. Furthermore, no change in protrusion of the diamond grit is observed, and the product is confirmed to have durability and excellent grain retention.

[EXAMPLE 2]

[0053] Diamond grit, coated with titanium carbide of about 2 micrometers by a CVD method, having a grain size of #100/#120 is mixed with titanium-silicon alloy powder at 1:1 by weight so as to make a mixture having a volume ratio of 1:3. Then, an obtained mixed powder is filled in a graphite frame, then it is sintered at a sintering temperature of 1,200 degrees Celsius and a pressure of 50 Mpa for an hour by hot-pressing. After an obtained sintered product is adhered to a pedestal 1 made from stainless steel (SUS 316) with an epoxy adhesive, the dressing face of the product is planarized and dressing-processed by using a GC grinding wheel size of #240 so that the thickness of the product and the height of protrusion of the diamond grit from matrix may be 2 millimeters and 50 micrometers, respectively. This becomes a dresser. The following acid-resistance test is a durability test for grid-peeling-off carried out for the dresser under the same conditions as in Example 1.

[0054] The result of the acid-resistance test is shown in FIG. 6. The figure shows that no increase in weight of the product is seen and the product has superior acid-resistance. Furthermore, similarly as in the first embodiment, peeling-off of the diamond grit and change in the height of protrusion are observed at four points on the dresser before and after dressing. Neither peeling-off of the diamond grit nor change in the height of the protrusion of the diamond grit is observed before and after dressing. The product is therefor confirmed to exhibit superior durability in holding grit.

[EXAMPLE 3]

[0055] Tungsten powder and silicon powder are mixed in a ball mill at a ratio of 1:4 by weight, 20% by volume of paraffin is added to the obtained mixed powder and mixed, and the obtained mixed powder is filled in a die to fabricate a planar molded body under a pressure of 50 MPa.

[0056] An adhesive sheet having an adhesive applied is masked by a sheet having a non-masking part formed by making many holes equivalent to the grit size at two-dimensional regular intervals. The adhesive parts formed by the non-masking part is 270 μm in size, and they are arranged so that the smallest lattice formed by the adjacent pieces of grit in the circumferential and radial directions is a parallelogram and the grit distance in one side thereof is at regular intervals of 0.8 mm.

[0057] Then, classified diamond grit of 150 μm to 250 μm is adhered and fixed on the non-masking part of the adhesive sheet, the sheet is placed on the molded body made of the tungsten-silicon mixed powder, the grit is pressed into the molded body via a plate, and then, the body is hot-press sintered under a sintering temperature of 1,200°C and a pressure of 50 MPa for one hour. In this way, a sintered body comprising grit fixed on the molded body is formed.

[0058] The obtained sintered body is bonded with epoxy resin on a cup-shaped pedestal which is made of stainless steel (SUS 316) and has a diameter of 100 mm so as to form a ring shape with 10 mm intervals, shot blasting is performed on the dressing surface of the sintered body by using unbound alumina with #240 particle size, and then, the body is planarized and dressed so that the protrusion height may be 60 μm to 80 μm. In this way, a dresser for a polishing cloth is fabricated.

[0059] The electron micrograph in Fig. 8 shows the arrangement of the grit on the dressing surface in the above-mentioned dresser for a polishing cloth.

[0060] The fabricated dresser is pressed on a polishing cloth made of polyurethane foam, which is rotated at 50 rpm, under a pressure of 19.6 kPa to be ground, while slurry (made by Cabot) containing 2% by volume of fumed silica is flows at about 15 ml per minute.

[0061] The polishing speed and surface roughness (Ra and Rz) of ten dressers are measured every 1, 2, 3, 5, 10, 15, 20, 25 and 30 hours, and the results are shown in Table 1.

[Table 1]

		Example 2	Example 1	Comparable Example
	Grit Distance	1.5mm	0.8mm	Electrode Position
Polishing Speed of Polishing Cloth (Unit: µm/H)	AVE	42.96	15.58	75.6
	on-1	2.59	2.80	11.25
Surface Roughness of Polishing Cloth Ra (Unit: µm)	AVE	4.95	3.93	4.33
	on-1	0.12	0.12	0.36
Surface Roughness of Polishing Cloth Rz (Unit: µm)	AVE	30.19	24.00	27.46
	on-1	1.15	0.96	2.61

[EXAMPLE 4]

[0062] As in the case of EXAMPLE 3, a planar sintered body is fabricated by using mixed powder of tungsten and silicon at a ratio of 1:4 by weight.

[0063] Also, as in the case of EXAMPLE 3, an adhesive sheet is masked by a sheet having a non-masking part, holes having a diameter of about 270 µm forming the non-masking part are arranged so that the smallest lattice formed by adjacent pieces of grit in the circumferential and radial direction is a parallelogram and a grit distance in one side thereof is at regular intervals of 1.5 mm, classified diamond grit of 150 µm to 250 µm is adhered and fixed on the non-masking part of the adhesive sheet, the sheet is placed on the molded body made of the tungsten-silicon mixed powder, and the sheet is hot-press sintered. In this way, a sintered body comprising grit fixed on the molded body is obtained.

[0064] The obtained sintered body is bonded with epoxy resin on the same pedestal as that used in EXAMPLE 1, shot blasting is performed on the operational surface using unbound alumina with #240 particle size, and then, the protruding height for a matrix of the diamond grit is adjusted to be 60 µm to 80 µm. In this way, a dresser for a polishing cloth is fabricated. The electron micrograph in Fig. 9 shows the arrangement of the grit on the dressing surface of the dresser for a polishing cloth.

[0065] The fabricated dresser is pressed on a polishing cloth made of polyurethane foam, which is rotating at 100 rpm, under a pressure of 19.6 kPa to be ground, while slurry (made by Cabot) containing 2% by volume of fumed silica flows at about 15 ml per minute.

[0066] The polishing speed and surface roughness (Ra and RZ) of ten dressers are measured every 1, 2, 3, 5, 10, 15, 25 and 30 hours, and the results are also shown in Table 1.

[COMPARATIVE EXAMPLE 1]

[0067] A polishing cloth made of polyurethane foam is ground under the same conditions as those in the case of EXAMPLES 3 AND 4 by using the same diamond grit as that in the case of EXAMPLES 3 and 4. The electron micrograph in Fig. 10 shows the arrangement of the grit on the dressing surface in the above-mentioned dresser for a polishing cloth. The results after grinding are shown in Table 1 together with the results of EXAMPLES 3 and 4.

[0068] Table 1 shows that, in the dresser for a polishing cloth in which the diamond grit is regularly arranged at equal intervals in the examples mentioned above, the surface roughness on the surface of the polishing cloth is more uniform than that on the surface of a conventional dresser on which grit is randomly arranged, and the polishing speed of the polishing cloth is very stable.

Claims

1. A dresser for a polishing cloth having a dressing face comprising a sintered product obtained by mixing a bonding material comprising silicon and/or silicon alloy with diamond grit, and forming and sintering the mixture such that a carbide film generated by sintering the silicon in the bonding material into the diamond is provided on the surface of said diamond grit, whereby the diamond grit is firmly bonded with the bonding material.

2. A dresser for a polishing cloth having a dressing face comprising a sintered product obtained by mixing a bonding material comprising silicon and/or silicon alloy with diamond grit coated with a film of a carbide of a metal in the group IV, V or VI of the periodic table, and forming and sintering the mixture, such that the diamond grit is firmly

bonded with the bonding material with said carbide film.

3. A dresser for a polishing cloth as claimed in either Claim 1 or Claim 2, wherein the sintered product is formed by mixing the bonding material with diamond grit, moulding the mixture to form a planar body, and sintering the moulded mixture.

4. A dresser for a polishing cloth as claimed in either Claim 1 or Claim 2, wherein the sintered product is formed by arranging each piece of grit on the surface of the bonding material with two-dimensional regularity, the distance between adjacent pieces of grit on the smallest lattice constructed by the arrangement is within a range between 10 μm to 3,000 μm, and each piece of grit is arranged so as to form a substantially uniform distribution.

5. A dresser for a polishing cloth as claimed in Claim 3 or Claim 4, wherein the sintered product is attached on the surface of a pedestal, the product is finished into specified size by planarizing and dressing the dressing surface thereof, and the diamond grit is exposed.

6. A method of manufacturing a dresser for a polishing cloth by mixing bonding material comprising silicon and/or silicon alloy with diamond grit, sintering the mixture such that a carbide film on the surface of the diamond grit is generated by sintering the silicon in the bonding material, and the diamond is firmly bonded with the bonding materials by the carbide film.

7. A method of manufacturing a dresser for a polishing cloth, wherein a bonding material comprising silicon and/or silicon alloy is mixed with diamond grit coated with a film of a carbide of a metal of group IV, V or VI of the periodic table, and the mixture is sintered whereby the diamond grit is firmly bonded with the bonding material by the carbide film.

8. A method of manufacturing a dresser for a polishing cloth, wherein adhesive regions whose size is almost the same as that of grit are provided on the surface of a planar bonding material comprising silicon or silicon alloy such as to enable attachment of diamond grit arranged in a uniform distribution with two-dimensional regularity, a particle of grit is adhered on each adhesive region and, after being pressed into the bonding member, sintered to generate a carbide film on the surface of the diamond grit by reactive sintering of the diamond and the silicon in the bonding material, whereby the diamond grit is firmly bonded to the bonding material by the carbide film.

9. A method of manufacturing a dresser for a polishing cloth, wherein adhesive regions whose size is almost the same as that of grit are provided on the surface of a planar bonding material comprising silicon or silicon alloy such as to enable attachment of diamond grit in a uniform distribution with two-dimensional regularity, diamond grit coated with a carbide film of a metal in group IV, V or VI of the periodic table is adhered on the adhesive regions and is then pressed into the bonding member and sintered to firmly bond the diamond grit to the bonding material by the carbide film.

10. A method of manufacturing a dresser for the polishing cloth as claimed in either Claim 8 or Claim 9 wherein the adhesive regions comprise non-masked parts of a masked adhesive sheet.

FIG. 1

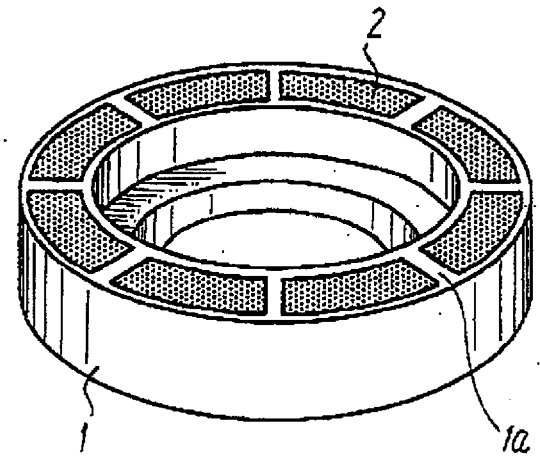


FIG. 2

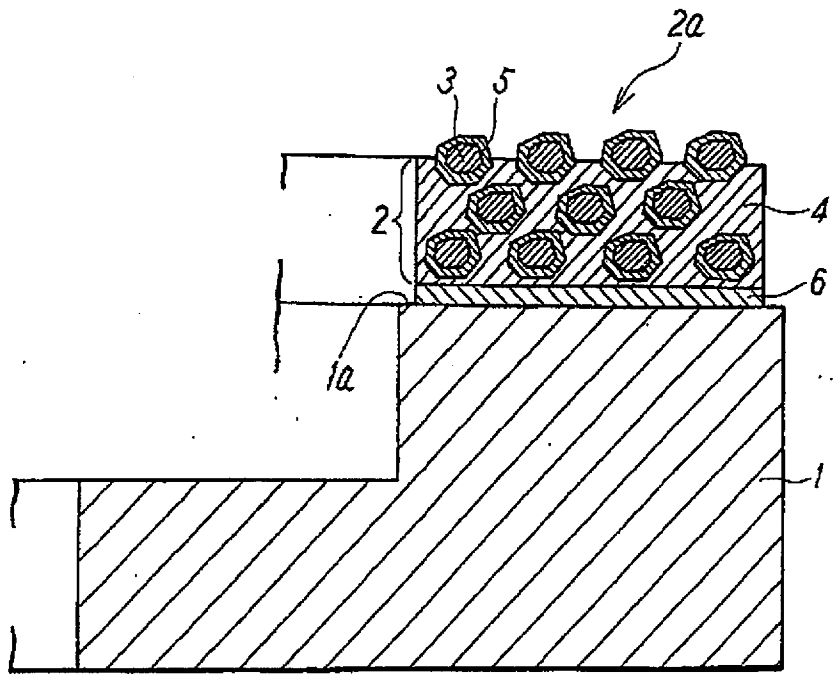
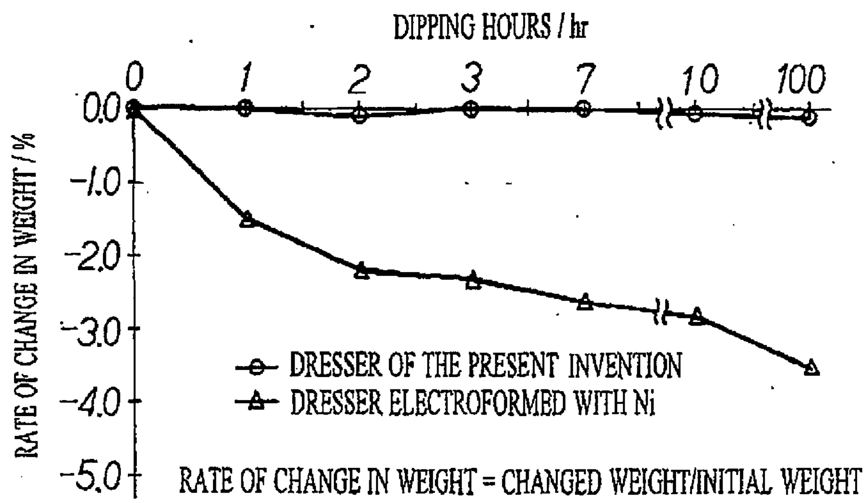


FIG. 3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3
7
10
100
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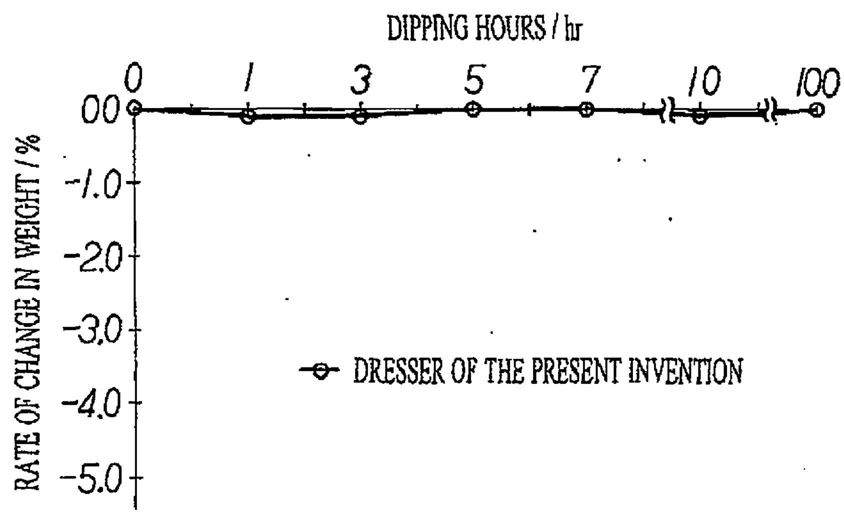
-3.0
-4.0
-5.0
RATE OF CHANGE IN WEIGHT / %
DRESSER OF THE PRESENT INVENTION
DRESSER ELECTROFORMED WITH Ni
RATE OF CHANGE IN WEIGHT = CHANGED WEIGHT/INITIAL WEIGHT

FIG. 6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-5.0
RATE OF CHANGE IN WEIGHT / %
DRESSER OF THE PRESENT INVENTION

FIG. 4

FIG. 5

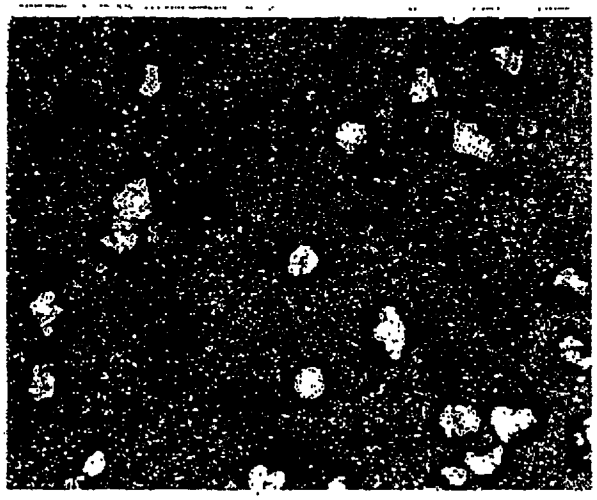

FIG. 7

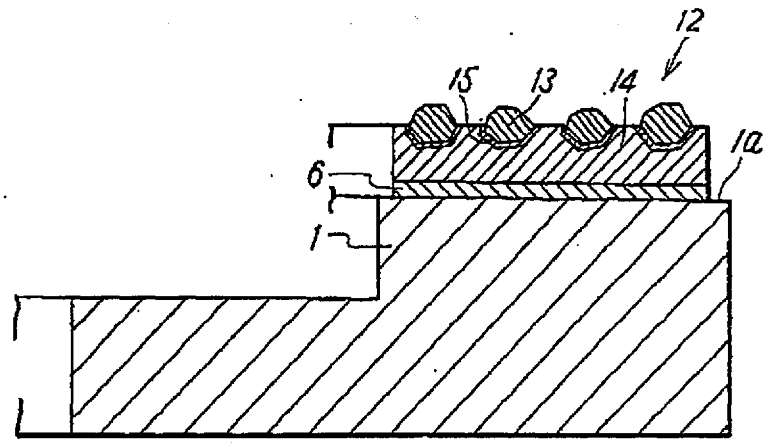

FIG. 8

FIG. 9

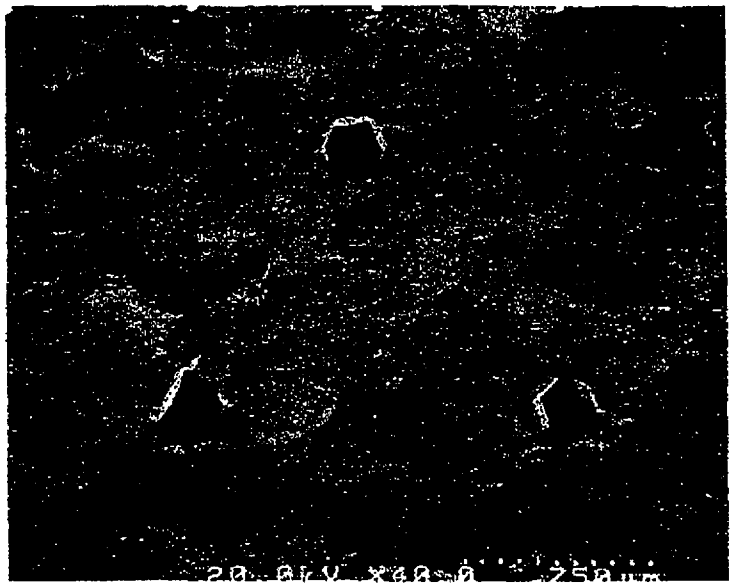

FIG. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 30 5243

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 October 2001	Garella, M

CATEGORY OF CITED DOCUMENTS

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